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*Weisia longiseta* Lesq. & James. 77
" *viridula* (L.) Hedw. 75
" " var. *nitida* R. & C. 74

SANFORD, FLORIDA.

## NOTES ON NORTH AMERICAN HEPATICAE—VIII[1]

ALEXANDER W. EVANS

(WITH PLATE II)

In a recent paper on New England Hepaticae[2] the writer discussed three species of *Nardia* (*N. hyalina*, *N. obovata* and *N. obscura*) and called attention to the discovery of *N. subelliptica* in Nova Scotia, this species being an addition to the American flora. In the present paper *N. subelliptica* and two other species of *Nardia*, *N. fossombronioides* and *N. rubra*, are considered; *N. fossombronioides* is an eastern species, which is perhaps to be expected in New England, while *N. rubra* is confined to the Pacific Coast region. The paper reports further two additions to the flora of the United States, *Petalophyllum Ralfsii* (which is new also to America) and *Leptocolea cardiocarpa*. The five remaining species are introduced for various reasons but mainly to record extensions of range or to help clear up difficulties in nomenclature.

Since the appearance of the seventh number of this series[3] an important article has been published by Arnell on the mosses of the Vega Expedition.[4] Most of the species considered came from Nova Zembla or Siberia but a few had been collected at Port Clarence or on St. Lawrence Island, Alaska. These include the following additions to the hepatic flora of the territory: *Cephalozia pleniceps*, *Cephaloziella striatula*, *Lophozia barbata*, *L. Binsteadii*, *L. Kaurini*, *Pleuroclada albescens*, and *Scapania subalpina*. In the writer's report on the Hepaticae of Alaska,[5] published in 1915, 105 species are recorded. Adding to these *Harpanthus Flotowianus* (which was omitted by mistake), *Asterella Lindenbergiana* (which has recently been reported in another paper),[6] and the seven species listed by Arnell, the total number of species now known from Alaska is increased to 114.

1. CORSINIA CORIANDRINA (Spreng.) Lindb. Hepat. Utveckl. 30. 1877. *Riccia reticulata* Gmel.; Linnaeus, Syst. Nat. ed. 13, **3**: 1355. 1796 (not *R. reticulata* Sw., 1788). *R. coriandrina* Spreng. Anleit. **3**: 320. 1804. *Corsinia marchantioides* Raddi, Opusc. Sci. Bologna **2**: 354. 1818. *Tessellina coriandrina* Dumort. Comm. Bot. 78. 1822. *Corsinia reticulata* Dumort. Hep. Eur. 166. 1874.

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[1] Contribution from the Osborn Botanical Laboratory.

[2] Rhodora **21**. 1919. *In press.*

[3] Bryologist **20**: 17–28. *pl. 2.* 1917.

[4] Arkiv för Botanik **15**$^6$: 1–111. 1917.

[5] Bull. Torrey Club **41**: 577–626. *pl. 21.* 1915.

[6] Contr. U. S. Nat. Herb. **20**: 284. 1919. *In press.*

Collected in February, 1915, near Austin, Texas, by F. McAllister. The specimens were determined by Dr. Marshall A. Howe, of the New York Botanical Garden, and reported by him (under the name *C. marchantioides*) at a meeting of the Torrey Botanical Club, held on March 31, 1915.[1] In 1887, Langlois[2] reported the species from Louisiana, but this earlier record is doubtful, and no other North American stations are at present known. In South America, however, it has been found in the vicinity of La Plata, Argentina, by C. Spegazzini.[3] Since the original discovery of the species by Micheli in the neighborhood of Florence, nearly two hundred years ago, its European range has gradually been extended, especially in the Mediterranean region, and it is now known from various other parts of Italy and also from Dalmatia, Switzerland (south of the Alps), France and Portugal. It has been reported also from Algeria, from the Atlantic Islands and from Japan. In certain parts of its range it is abundant.

The genus *Corsinia* is monotypic and was placed by the older writers, including Leitgeb, among the Ricciaceae. At the present time its relationships are supposed to be with the more complex genera of the Marchantiales. Cavers has united it with the South American genus *Boschia* to form the special family Corsiniaceae, which occupies a position in his system between the Ricciaceae and *Targionia*. The features of the genus have been well described by European writers,[4] so that only the more distinctive will be noted here.

The thallus is of a fair size, measuring 5–6 mm. in width, and its color varies from yellowish to bright green, without showing any traces of purplish pigmentation. It branches rather sparingly by forking and occasionally forms apical innovations. The photosynthetic tissue is made up of a single layer of air-chambers, separated by plates of cells and covered over by a thin-walled epidermis one cell thick. Each chamber communicates with the outside air by means of an epidermal pore, surrounded by one or two concentric rows of scarcely modified thin-walled cells. The floors of the chambers sometimes give rise to short and simple, upright green filaments, each composed of a single row of cells, but these filaments are often lacking altogether. The ventral scales are colorless and irregularly scattered; they are ovate to lunulate in outline, and each tapers gradually into a filamentous appendage.

The inflorescence is usually dioicous but may be autoicous. The most important characters of the genus are derived from the grouping of the sexual organs and from the protective structures associated with them. The antheridia are situated in an elongated and sometimes forked cluster, occupying a median position on an ordinary thallus and bounded on each side by a low ridge. The archegonia occupy a similar position, but the groups, which are in shallow depressions, are shorter, and several are sometimes formed in rather close succession, showing that the formation of the archegonia does not limit the growth of the thallus. In the lack of a specialized female receptacle the genus differs from such typical marchantiaceous genera as *Marchantia*, *Reboulia* and *Plagiochasma* and agrees with the more simply organized genera, such as *Targionia* and *Riccia*. Involucral organs may be absent altogether. When they occur they attain full development only after fertilization and are in the form of one-sided or peltate, lobed structures with air chambers, taking their origin from the surface of the thallus and arching up over the young sporophytes. The calyptra is fleshy and covered over with coarse tubercles.

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[1] See Torreya **15**: 159. 1915.

[2] Cat. Pl. Basse-Louisiane 26. 1887.

[3] See Massalongo, Bull. Soc. Bot. Ital. 1917: 45.

[4] See especially Müller, Rabenhorst's Kryptogamen-Fl. **6**: 226–229. *f. 142, 143.* 1907; and Cavers, New Phytol. Reprint 4: 18–22. *f. 8,* 9. 1911.

The sporophyte[1] shows the usual differentiation into capsule, stalk and foot, but the stalk remains very short. The wall of the capsule is composed of a single layer of thin-walled cells and dehisces at maturity, according to Meyer, by means of a long slit in the upper part. The spore sac contains both spores and sterile cells, the latter being short and blunt and destitute of spiral thickenings in their walls. The spores are blackish brown and almost opaque at maturity, usually measuring 100–130$\mu$ in diameter. They show the usual tetrahedral form, though somewhat obscurely. The plane faces are smooth but the spherical face is covered over with a coarse reticulum. The meshes measure 25–35$\mu$ in diameter and are bounded by grooves and not by ridges, a remarkable feature first pointed out by Leitgeb.[2] This type of spore-marking is not known in any other North American hepatic but recurs, with certain modifications, in the European *Grimaldia dichotoma* Raddi.[3]

2. SAUTERIA ALPINA Nees, Naturg. Europ. Leberm. **4**: 143. 1838. *Lunularia alpina* Nees; Nees & Bisch. Flora **13**: 399. 1830.

Collected on soil among rocks, in July, 1881, on Mt. Albert, Gaspé County, Quebec, by O. D. Allen (*No. 1*). These specimens have already been reported by the writer[4] under the incorrect name *Clevea hyalina* (Sommerf.) Lindb. Careful sectioning of the scanty material, however, has demonstrated the presence of a rhizoid-furrow in the stalk of the female receptacle, showing that the plant is *Sauteria alpina* and not the *Clevea*. Additional North American stations for the *Sauteria* are in Greenland, Alaska and Alberta; and it has a wide distribution in Europe and northern Asia.

A full description of this arctic and alpine plant may be found in Müller's "Lebermoose,"[5] while the characteristics of the group Astroporae, to which it belongs, have already been briefly discussed by the writer.[6] The most important distinction between *Clevea* and *Sauteria* is found in the stalks of the female receptacle; in *Clevea* there is no rhizoid-furrow, in *Sauteria* a single one is present. In *Clevea* the receptacle is dorsal on a thallus branch and does not limit its growth; in *Sauteria* it is terminal and brings the growth of the branch to an end. An important distinction between *Clevea hyalina* and *Sauteria alpina* is found in the paleae associated with the female receptacles. In the *Clevea* there are few or no slime-papillae on the paleae; in the *Sauteria* the papillae are very numerous.[1]

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[1] The following two papers by Meyer give a full account of the development and structure of the sporophyte: Untersuchungen über den Sporophyt der Lebermoose—I. Entwickelungsgeschichte des Sporogons der *Corsinia marchantioides*. Bull. Soc. Imper. Nat. Moscou 1911: 263–286. *pl.* 7+*f.* 1–22. 1912; III. Das Sporogonium der *Corsinia marchantioides* Raddi. Ber. Deuts. Bot. Ges. **32**: 262–266. *f.* 1–4. 1914.

[2] Ueber Bau und Entwicklung der Sporenhäute 22–38. *pl.* 1, *f.* 16–33. 1884.

[3] See Leitgeb, *op. cit.* 50. *pl.* 2, *f.* 28, 28*a*.

[4] Bryologist **19**: 28 (footnote). 1916.

[5] Rabenhorst's Kryptogamen-Fl. **6**: 241. *f.* 150, 151. 1907.

[6] Rhodora **16**: 63. 1914.

3. PLAGIOCHASMA MUENCHIANUM Steph. Sp. Hepat. **6**: 9. 1917.

This species was based on specimens collected by G. Münch at San Cristobal, Chiapas, Mexico. From a study of these specimens several years ago,[2] before the species had been published, the writer reached the conclusion that they represented a form of *P. crenulatum* Gottsche. It is therefore suggested that *P. Muenchianum* be placed among the synonyms of *P. crenulatum*.

4. GRIMALDIA PILOSA (Hornem.) Lindb. Musc. Scand. 1. 1879. *Marchantia pilosa* Hornem. Fl. Dan. **8**: 7. *pl. 1426.* 1810. *Duvalia pilosa* Lindb. Not. F. et Fl. Fenn. **9**: 280. 1868. *Neesiella pilosa* Schiffn. Hedwigia **47**: 314. 1908.

Collected in June, 1893, on Cold Creek Hill, Yukon River, Alaska, by F. Funston (*No. 94*). This specimen was reported by the writer some time ago under the incorrect name *G. fragrans* (Balb.) Corda;[3] since, however, the thallus shows large air chambers the plant clearly belongs to *G. pilosa*, and *G. fragrans* should no longer be included among the species known from Alaska. *G. pilosa* is an arctic and alpine species which occurs at various scattered localities in northern Europe and Asia. In North America it is known from Greenland, Quebec and Vermont, as well as from Alaska.

In the second paper of this series[4] *G. pilosa* is included in the genus *Neesiella*, following the example of Schiffner, but it is shown that the reasons for separating *Neesiella* from *Grimaldia* are not very convincing, being based simply on differences in the structure of the thallus. Since the related genus *Asterella* shows equally great differences, it is now suggested that *Neesiella* be again combined with *Grimaldia*. As thus enlarged the genus is represented in North America by the following species: *G. californica* Gottsche, *G. fragrans*, *G. pilosa*, and *G. rupestris* (Nees) Lindenb., the last species being the type of the genus *Neesiella*.

5. PETALOPHYLLUM RALFSII (Wils.) Nees & Gottsche; Lehmann, Pug. Plant. **8**: 30 (in obs ). 1844. *Diplolaena Lyellii α lamellata* Nees, Naturg. Europ. Leberm. **3**: 345. 1838. *Jungermannia Ralfsii* Wils.; Sowerby, Engl. Bot. Suppl. **4**: *pl. 2874.* 1843. *Petalophyllum lamellatum* Lindb. Not. F. et Fl. Fenn. **13**: 390. 1874 *Fossombronia corbulaeformis* Trabut, Rev Bryol. **13**: *pl. 2, f. 9–14.* 1886 (no description); Battandier & Trabut, Atlas Fl. d' Alger 7. *pl. 2, f. 9–14.* 1886.

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[1] See Solms-Laubach, Bot. Zeit. **57**¹: 19. 1899.

[2] Bull. Torrey Club **42**: 289, 292. 1915.

[3] Proc. Washington Acad. **2**: 290. 1900.

[4] Bryologist **14**: 84. 1911.

Collected in March, 1914, at Austin, Texas, by Miss M. S. Young (*No. 2;* specimen in the herbarium of the New York Botanical Garden); also at College Station, Texas, by C. H. Farr. New to America. This rare species was discovered by J. Ralfs, in 1830, at Aberffraw, on the island of Angelsey in Wales, and is now known in addition from the English counties of Cornwall, Lancaster and York and from the Irish counties of Dublin, Kerry and Londonderry. For a long time it was supposed to be confined to the British Isles, but about fifty years after its original discovery it was found by Trabut at various localities in the vicinity of Algiers. He described it as a new species, under the name *Fossombronia corbulaeformis*, but the identity of his plant with the *Petalophyllum* was soon recognized. Largely through the studies of Massalongo the species is now known also from the following islands in the Mediterranean: Pianosa (Tuscan Archipelago), Sardinia, Sicily, Lampedusa (southwest of Sicily), and Malta. Its discovery in America marks a very interesting extension of range.

The genus *Petalophyllum*, as originally proposed, contained only two species, *P. Ralfsii* and the Australian *P. Preissii* Gottsche. The latter is apparently as rare as *P. Ralfsii*, although its known range now includes New Zealand. When Stephani monographed the genus in 1900[1] he still recognized the two original species but no others. Since that time, however, he has proposed a third species, under the name *P. bolivianum.*[2] This species presumably came from Bolivia, although he describes the habitat as "sine loco natali." It is unfortunately known in sterile condition only, but the description indicates that it must be close to *P. Ralfsii.* For descriptions of *P. Ralfsii* reference may be made to the European manuals and to an important morphological study by Cavers.[3] This work has served as the basis for most of the remarks which follow.

The gametophyte consists of a green, flattened, thalloid stem about 1 cm. long, which is sometimes simple and sometimes once-dichotomous. This stem broadens out from a cylindrical stalk-like base and lies closely appressed to the surface of the soil. It consists of a thickened median portion, which forms a long convex ridge on the ventral surface, and two wings which thin out gradually, becoming only one cell thick in the outer part. On the upper surface of the wings a series of oblique lamellae, which are regarded as leaves, take their origin. These lamellae are only one cell thick and are usually somewhat imbricated. They are broadest in the middle, where they attain a width of about twenty cells, and narrow gradually toward each end. The lamellae on one wing tend to alternate with those of the other, but there are often deviations from this arrangement; two or more lamellae on the same wing, for example, may be "joined by a membranous outgrowth," or two lamellae of opposite wings may be continuous with each other across the middle. On the lower surface the stem "bears numerous small scales in two longitudinal rows." These are developed early and appear crowded in the apical region, becoming withered and indistinguishable in the older parts of the plant. The scales are triangular in form and are provided with slime-papillae. Toward the end of the growing period the flattened stem forms an apical tuber, which persists until the following season and then grows out into the cylindrical base of a new stem. The method of growth and the formation of the tuber are clearly shown in a figure by Goebel.[1]

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[1] Mem. Herb. Boissier **16**: 16. 1900.

[2] Sp. Hepat. **6**: 70. 1917.

[3] Notes on Yorkshire Bryophytes. 1. *Petalophyllum Ralfsii.* Naturalist 1903: 327–334. *f. 1–4.*

The antheridia and archegonia of *P. Ralfsii* are borne on separate plants. The yellow antheridia are borne on the upper surface of the thickened median portion and show a tendency to be arranged in two longitudinal rows. Some but apparently not all of the antheridia are protected by scale-like or tubular outgrowths, and these sometimes grow together and form a system "of chambers, each containing a single antheridium." The archegonia and associated parts are clearly described by Cavers. According to his account a "female plant bears several groups of archegonia," protected by "narrow scales or leaf-like outgrowths." If fertilization takes place in a group, "the perianth begins to grow up as a tubular sheath which surrounds the whole group . . . . within the ring of scales." As it "grows upward some of the scales are carried up on its outer surface." The mature perianth is wide open at the mouth, which bears a series of irregular lobes or sharp teeth.

The spherical capsule is essentially like that of a *Fossombronia* and splits irregularly at maturity. Spores are abundant in the material collected by Miss Young and agree closely with the description and figure of Macvicar.[1] They are pale brown at maturity and measure 50–60μ in diameter. The whole surface is covered over by a coarse and regular reticulum formed by anastomosing lamellae 6–10μ wide. The meshes are mostly hexagonal and measure 10–16μ across, while the lamellae are darker on their edges and very minutely crenulate. The elaters have blunt ends and most of them are narrow, measuring 10–14μ in diameter; occasional elaters, however, are much broader. It will be seen that the spores are strikingly like those of *Fossombronia angulosa* Raddi.

6. NARDIA FOSSOMBRONIOIDES (Aust.) Lindb. Acta Soc. Sci. Fenn. **10**: 530. 1875. *Jungermannia fossombronioides* Aust. Proc. Acad. Philadelphia for 1869: 220. [TEXT FIGS. 1–7.]

NEW JERSEY: On rocks along a rivulet, near Closter, *C. F. Austin*, distributed in Hep. Bor.-Amer. *32*, as *Jungermannia fossombronioides;* Englewood, *M. A. Howe.* WEST VIRGINIA: near Burnt House, *J. L. Sheldon 4226, 4233* in part, mixed with *N. crenuliformis* (Aust.) Lindb. ILLINOIS: Canton, *J. Wolf 30.* The range of this interesting species is still incompletely known, and these are the only stations which can be cited with certainty. The specimens from Macon, Georgia, distributed under this name in Underwood & Cook's Hep. Amer. *39*, are sterile and doubtful.

In Austin's original description of this rare species he emphasized its most distinctive feature, the "large, subcampanulate and multi-plicate perianth."

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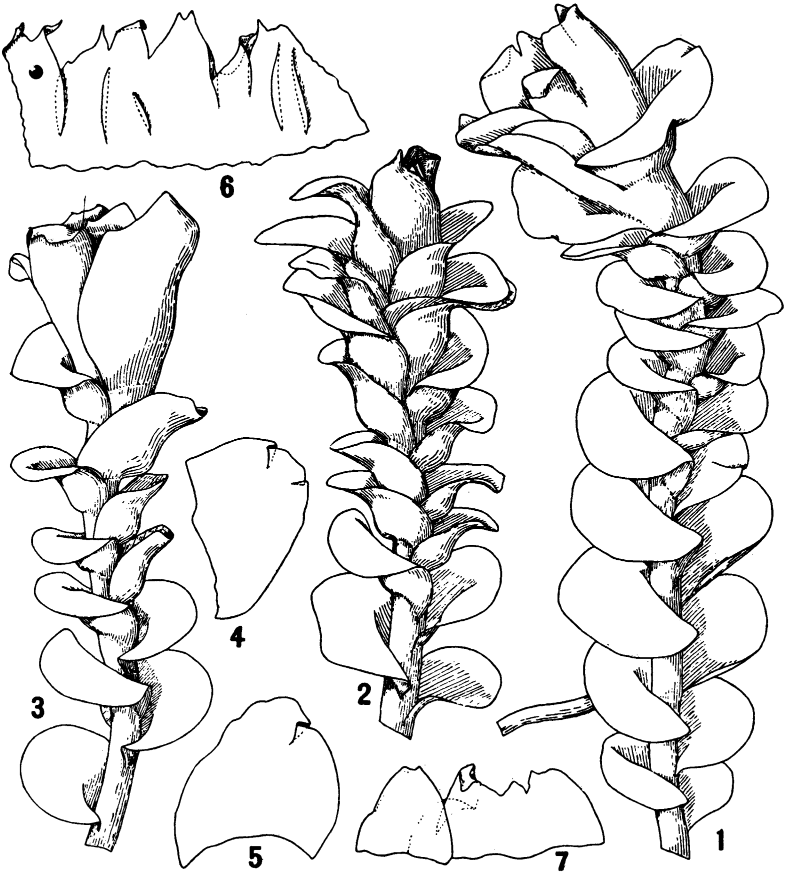
[1] Organogr. der Pfl. ed. 2, *f. 533.* 1915.

[2] Student's Handb. British Hep. 79. *f. 3.* 1912.

He called attention further to its deeply laciniate mouth and to the fact that it was "highly connate" with the bracts. In transferring the species to the genus *Nardia,* Lindberg was so impressed with the peculiarities of the perianth that he made them the basis for the new section *Chascostoma* and even suggested that this section might represent a valid genus. He noted the paroicous inflorescence of the species, the presence of long flagella or stolons and the absence



NARDIA FOSSOMBRONIOIDES (Aust.) Lindb.

FIGS. 1–3. Plants with perianths and perigonial bracts, ×15.

FIGS. 4, 5. Innermost perichaetial bracts from a single inflorescence, ×15.

FIG. 6. Mouth of perianth from the same inflorescence, ×15.

FIG. 7. Mouth of perianth from another inflorescence, ×15.

The figures were all drawn from specimens collected near Closter, New Jersey, by C. F. Austin and distributed in Hep. Bor.-Amer. *32*, as *Jungermannia fossombronioides.* The rhizoids are not represented.

of underleaves. Schiffner also was impressed by the features of the perianth, although he still retained *Chascostoma* (with a question mark) among the subgenera of *Nardia.*[1]

In FIGS. 1–3 more or less characteristic perianths are shown and in FIGS. 6 and 7 the upper parts of two other perianths are represented, dissected off and spread out flat. The figures indicate that the perianth is a somewhat variable organ. In most cases the apical lobes or laciniae are irregular in number, size and shape. They tend to flare out a good deal and are frequently revolute, but sometimes they are suberect or even involute, thus partially closing the mouth. In many cases the perianths are incompletely or abnormally formed. A lobe, for example, instead of meeting the next lobe directly, may extend down the outer surface of the perianth for a considerable distance in the form of a free lamella. Austin described the margins of the laciniae as entire. As a matter of fact the marginal cells usually project as vague crenulations, and sometimes minute and irregular teeth are present. The cells of the perianth vary considerably, although elongated cells are usually present somewhere. Even at the mouth the cells are often isodiametric, an unusual condition in the genus *Nardia*, but this feature is inconstant and the marginal cells are sometimes elongated. In the writer's opinion the features of the perianth in *N. fossombronoides* have perhaps been over-estimated as a sectional or subgeneric character, but they certainly form an excellent basis for separating the species from its allies.

Passing now to the vegetative organs the resemblance between *N. fossombronioides* and the northern *N. obovata* (Nees) Lindb. is striking. The plants are of about the same size, they are both distinguished by the presence of purple rhizoids and long stolons, the branching in both is intercalary, and both (so far as observed) show a complete lack of subfloral innovations. The leaves, moreover, are of about the same shape and spread in about the same way, while the leaf-cells are characterized by small but distinct trigones. Even the measurements of the leaf-cells yield no differences. In *N. fossombronioides* the marginal cells average about 23μ and the median about 36×31μ, these measurements coming well within the extremes found in the more variable *N. obovata.* There are, however, a few differences even in the vegetative organs. In *N. obovata* the rhizoids rarely extend to the vicinity of the apex, owing to the fact that only the older parts of the stem are prostrate; they show furthermore no tendency to form a ventral longitudinal strand; and the cuticle of the leaves is usually striolate-verruculose, at least in part. In *N. fossombronioides,* on the other hand, rhizoids extend close to the apical region; they often show a tendency to form a ventral longitudinal strand; and the cuticle of the leaves is smooth.

Although the inflorescence is normally paroicous in *N. fossombronioides* (as noted by Lindberg) a plant will sometimes give rise to a series of male bracts and then continue its growth vegetatively. In normal cases the number of male bracts formed is from three to six pairs, which is somewhat in excess of the number found in *N. obovata.* The bracts usually spread widely from a basal sac, and the apical portion is sometimes slightly reflexed. Even the bracts next to the perianth usually enclose antheridia, although the innermost bract on one side may be free from them. The perigynium, even when fertilization has taken place, is exceedingly shallow, thus differing from *N. obovata*, and it is rare for more than one bract to be borne on it.

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[1] Engler & Prantl, Nat. Pflanzenfam. $1^3$: 79. 1893.

The material at the disposal of the writer has been insufficient for the study of mature capsules, and these are not described in the published accounts beyond the fact that they are oval. A section cut through the stalk of a young sporophyte shows a somewhat more complex condition than in *N. obovata;* the outermost row is composed of twenty-four cells, the second of eighteen, and the innermost cells, which form an irregular group, number eleven. These numbers are high for the genus *Nardia* but in all probability a good deal of variation would be found if numerous sporophytes were compared.

Another paroicous *Nardia, N. Geoscyphus* (De Not.) Lindb., has been found in New Jersey, but there is little danger of confusing it with *N. fossombronioides*, on account of the fact that some of its leaves are retuse at the apex or even distinctly bilobed. It is further distinguished by an occasional terminal branching, giving rise to an apparent dichotomy; by small underleaves, distinct in the apical portion; and often, in the case of fertile plants, by a short bulbous perigynium.

7. **Nardia rubra** (Gottsche) comb. nov. *Jungermannia rubra* Gottsche; Bolander, California Med. Gaz. 1870: 184 (nomen nudum); Underwood, Bot. Gaz. **13**: 113. *pl. 4.* 1888. [Plate II, figs. 1–7.]

British Columbia: Ucluelet, *J. Macoun 33, 35, 72;* Hastings, *J. Macoun 208, 1245;* Stanley Park, Vancouver, *J. Macoun 118, 119;* Goldstream, Vancouver Island, *J. Macoun 21.*

Washington: Renton, *T. C. Frye 22;* Seattle, *T. C. Frye 1, C. V Piper 101* (also distributed, under a manuscript name, in Underwood & Cook's Hep. Amer. *169*); Ilwaco, *T. C. Frye 2066, 2068;* near Cathlamet, *A. S. Foster 512;* Houghton, *T. C. Frye 590;* Tacoma, *J. B. Flett;* Aberdeen, *A. S. Foster 950;* Pacific Beach and vicinity, *A. S. Foster 1447, 1496;* above Hoquiam, *A. S. Foster 759;* Bainbridge, *A. S. Foster 1959;* Montesano, *J. M. Grant 2035, 2040.*

California: Without definite locality, *H. N. Bolander;* Santa Cruz, *W. G. Farlow;* Santa Cruz Mountains, *L. M. Underwood* (distributed, as *N. crenulata*, in Hep. Amer. *200*); near Lake San Andreas, San Mateo County, *M. A. Howe 44;* Cazadero, Sonoma County, *M. A. Howe 1226.*

Many of these specimens have been recorded elsewhere under the name *N. crenulata* (Sm.) Lindb. According to the information at hand, *N. crenulata* is restricted in North America to the eastern part. Stephani reports it from Greenland, but the writer has seen no specimens from farther north than Prince Edward Island and Cape Breton Island, Nova Scotia. Toward the south it increases in frequency, becoming one of the commonest species in southern New England and New York. The southernmost specimens examined came from Alabama and the westernmost from West Virginia, but records from Ohio are available. The species has a wide distribution in Europe, and Stephani lists it from Japan. *N. rubra*, on the other hand, seems to be confined to the Pacific

Coast region of North America. Both species grow on sandy or clayey banks, often along roadsides, and *N. rubra* is sometimes found on friable sandstone.

The species was named by Gottsche many years ago and was based on specimens collected by Bolander "on metamorphic sandstone" at Mendocino City, California. It was not published by its author but remained a manuscript species, except for its inclusion in Bolander's catalogue of San Francisco plants, until 1888, when Underwood had Gottsche's original figures reproduced, supplying them with a short diagnosis. He was able to add a second station, "cliffs by the sea, Santa Cruz, California, where the plant had been found by Farlow. In 1891 it was still listed as a valid California species by Underwood,[1] but in 1899 it was included by Howe[2] among the synonyms of *N. crenulata.* In adopting this course he states that "the Californian forms mostly agree with Gottsche's *Jungermannia rubra,* founded on a specimen collected . . . by Dr. Bolander, but *Jungermannia rubra* seems to us not to differ in any structural characters from the European conditions of *Nardia crenulata* which have at times been known as *Jungermannia gracillinia* and *J. Genthiana.*" Howe's views have been accepted by subsequent writers, and *N. crenulata* has been recorded not only from California but also from Washington and British Columbia.[3]

In studying a large series of specimens from the Pacific Coast region, which had been determined as *N. crenulata,* the writer was impressed by certain features which seemed to distinguish them from authentic material of that species coming from Europe and eastern North America. The differences noted are slight and the most important of them attracted the attention of Howe. He regarded them, however, as insufficient to serve as a basis for specific separation, especially when the great variability of *N. crenulata* was taken into account. The Pacific Coast plants are likewise very variable, and certain forms occur which are distinguished with difficulty from certain forms of *N. crenulata.* At the same time the agreement is between poorly developed forms, rather than between robust forms, and the range of variability shown by the Pacific Coast series is different from that of the authentic *N. crenulata.* In view of these facts the writer suggests that Gottsche's *Jungermannia rubra* be reinstated as a species, under the name *Nardia rubra,* even if many writers would regard it as nothing more than a "small" species.

The numerous European forms of *N. crenulata* have been carefully studied by European botanists and especially by Schiffner,[4] but the views regarding them and their nomenclatorial status are still very much at variance. Schiffner recognizes the following varieties, in addition to the typical form of the species: *gracillima* (Sm.) Lindb., *cristulata* (Dum.) Schiffn., *turfosa* (Warnst.) Schiffn., *subaquatica* Schiffn., *inundata* (Husnot) Schiffn., and *exundata* (Husnot) Schiffn. The last four of these varieties are aquatic or subaquatic in habit. He regards

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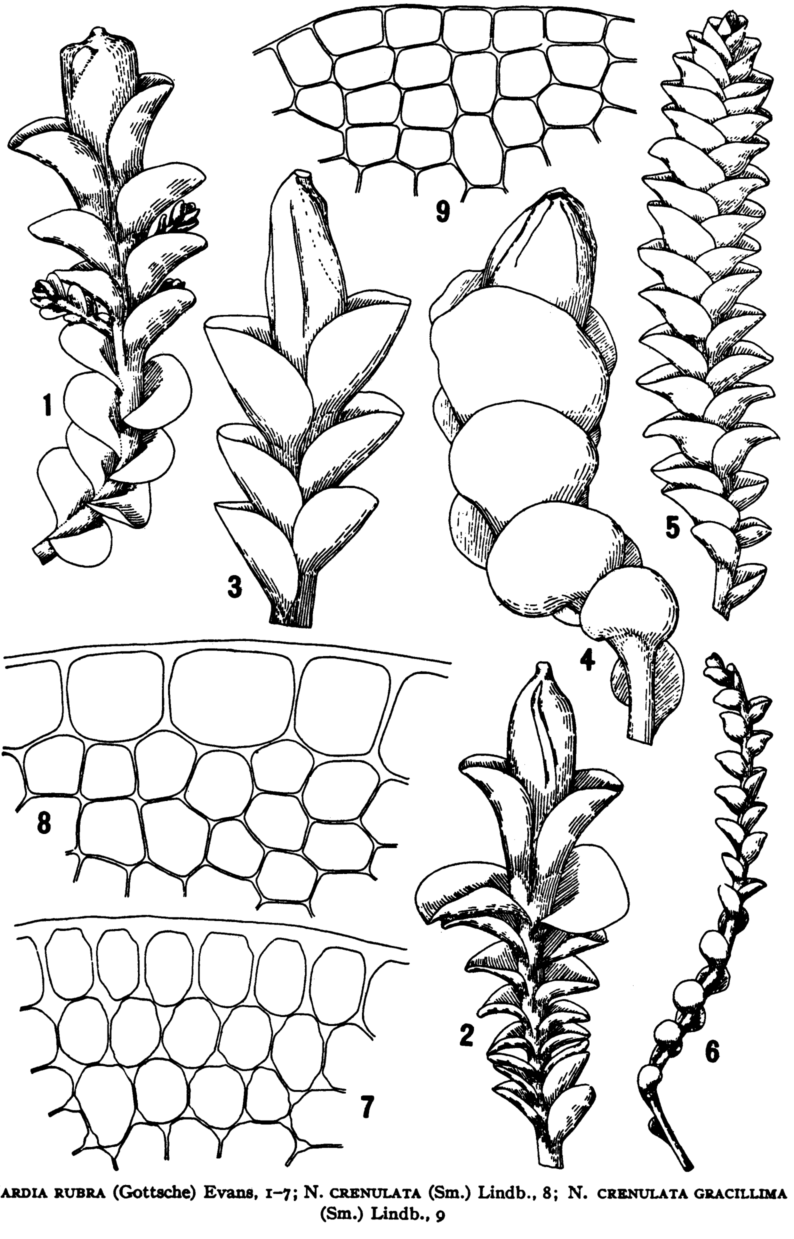
[1] Zoe **1**: 365. 1891.

[2] Mem. Torrey Club **7**: 94. 1899.

[3] See Miss Haynes, Bryologist **12**: 67. 1909; and Macoun, Cat. Canadian Pl. 7: 13. 1902.

[4] Verhandl. der K. K. zool.-bot. Gesellsch. in Wien **53**: 410–418. 1904; Lotos **58**: 271. 1910.



NARDIA RUBRA (Gottsche) Evans, 1–7; N. CRENULATA (Sm.) Lindb., 8; N. CRENULATA GRACILLIMA (Sm.) Lindb., 9 var. *cristulata* as a possible subspecies, on account of the fact that its distinctive features seem to be hereditary. Müller[1] accords varietal rank to the var. *cristulata* but reduces the var. *gracillima* to a form and groups the vars. *turfosa*, *subaquatica* and *inundata* under the forma *elatior* Gottsche, as mere synonyms. According to Loeske[2] the var. *gracillima*, although apparently only a biological "Kleinform" of *Eucalyx crenulata* (as he calls it), adapted to hard and bare footpaths, occurs nevertheless so independently in the Harz Mountains and other localities that he gives it specific rank under the name *E. gracillima*. He suggests, moreover, that his *E. gracillima* may represent the original species, from which *E. crenulata* has been derived. Warnstorf seems to be even surer that the var. *turfosa* is not an aquatic form of *N. crenulata*. According to his last-expressed opinion[3] it is a distinct species, which he designates *Haplozia turfosa* Warnst.

Of Schiffner's six varieties the only one which is certainly known from North America is the var. *gracillima*. This sometimes occurs in pure mats, just as it does in Europe, and sometimes in admixture with the typical form of the species. Under the latter circumstances it presents the appearance of being a juvenile state of the typical form, and this may well be its true explanation. Even if this is the case, however, there may be two closely related races or "small" species, one which advances beyond the juvenile state and one which does not. This would account for the fact that the var. *gracillima* evidently occurs by itself in certain regions, to the exclusion of typical *N. crenulata*. Unfortunately very little is known at the present time about the effects produced on the Hepaticae by modifications of the environment, so that the various problems raised by var. *gracillima* and by the other varieties of *N. crenulata* must still await solution.

As Howe has pointed out the Californian forms of *N. rubra* resemble the var. *gracillima* rather than typical *N. crenulata*. The leaves almost always lack enlarged marginal cells, and the leaf-cells throughout are essentially the same in structure. This condition tends to persist, even in the most robust forms, but the marginal cells then acquire characteristics unlike those found in robust forms of *N. crenulata*. In order to make these points clear the structure of the leaves in the two species will be considered at some length, even at the risk of repeating well-known facts.

In *N. crenulata* the leaf-cells and their walls have been variously described by writers. According to Schiffner the walls, both in the typical form and in the var. *cristulata*, are almost uniformly thickened throughout, and he uses this feature in separating critical forms of the species from *N. hyalina* (Lyell.) Carringt., where trigones are invariably present. According to Müller the walls are thin and trigones are either slightly developed or absent altogether. According to Hesselbo,[4] who discusses Icelandic forms, plants which are "low" and "reddish-brown" have cells which are "especially distinctly collenchymatous, while the more vigorous green forms . . . . have thin-walled cells which are indistinctly collenchymatous."

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[1] Rabenhorst's Kryptogamen-Flora **6**: 542. 1909.

[2] Hedwigia **49**: 9. 1910.

[3] Kryptogamenfl. der Mark Brandenburg **2**: 1113. 1906.

[4] Rosenvinge & Warming, Bot. Iceland **1**: 410. 1918.

The writer has found the following conditions in typical forms of the species, such as the specimens from the vicinity of Berlin, collected by Osterwald and distributed by Schiffner (Hep. Europ. Exsic. *57*), or the specimens from Nova Scotia, collected by Nichols (*No. 1376*). The marginal row of cells is distinct all the way round (except at the very base) and in the apical portion (PLATE II, FIG. 8) stands in especially sharp contrast to the cells just within; toward the base the contrast becomes less striking. The cells average about 40μ in both radial and tangential dimensions, but the latter often vary between 30 and 50μ. The outer walls are sometimes 8μ thick; the radial walls appear almost as thick (as the figure shows), but careful focusing shows a large thin place in each; the inner walls are somewhat less thickened and present the appearance of having large pointed trigones with concave sides. The cells just within the marginal cells average only 20μ in diameter and are therefore only a quarter the size of the marginal cells in surface extent. Their walls (except those common to the marginal cells) are very slightly thickened, and it is often difficult to say whether trigones are present or not; even in extreme cases the trigones are minute with strongly concave sides. Toward the base of the leaf the cells gradually increase in size and especially in length, the median cells measuring about 40×28μ; their walls are even thinner than those of the submarginal cells, and their trigones, although no larger, appear somewhat more distinct. The cuticle is everywhere verruculose or striolate-verruculose.

In the var. *gracillima*, as represented by specimens collected in the Vosges Mountains by Müller and distributed by Schiffner (Hep. Europ. Exsic. *361*), the conditions are very different (PLATE II, FIG. 9). There is no contrast, either in size or structure, between the marginal and submarginal cells, both averaging about 22μ in diameter; toward the base the cells become longer but scarcely wider, the median cells averaging about 29×22μ. The walls are everywhere slightly thickened but minute trigones with concave sides can often be demonstrated; the cuticle is smooth or nearly so throughout.

Under certain circumstances the more "collenchymatous" appearance noted by Hesselbo presents itself. The specimens collected by Underwood at Auburn, Alabama, and distributed by Miss Haynes (Amer. Hepat. *61*) represent this condition. According to the label they were found "on rocks in a ravine," but the rocks were either covered with earth or much disintegrated, because the substratum of the plants is in the form of minute granules loosely held together. The plants are small and deeply pigmented and seem to have grown in an exposed locality. Their leaves are distinctly bordered, just as in the typical form, but the contrast in size between the marginal and submarginal cells is somewhat less, the marginal cells averaging only 32μ in diameter and the submarginal 18μ. The smaller size of the marginal cells may be associated with the fact that the leaves themselves are distinctly smaller than in the usual form of the species. With regard to the cell-walls the marginal cells present no aberrant features, but the other cells have thicker walls than usual and the trigones are distinctly larger. Even here, however, the trigones run out to acute points and have concave sides, so that the boundaries between the trigones and the thinner parts of the wall are not distinct.

The conditions found in *N. rubra* may now be considered. In what may be regarded as the typical form of the species, such as the material collected at Renton, Washington, by Frye (*No. 22*), the leaves appear bordered (PLATE II, FIG. 7), but the marginal cells are distinguished less by their size than by the peculiarities of their walls. According to a series of measurements the marginal cells average 24μ in width and the submarginal 22μ; toward the base the usual increase in size is apparent but is more gradual and less marked than in typical *N. crenulata*, the median cells averaging about 30×25μ. The walls of the marginal cells are thickened, much as in *N. crenulata*, and thin places can be distinguished in the radial and inner walls, leaving large and sometimes confluent trigones; but the latter usually show straight or convex sides. The trigones are somewhat smaller along the inner walls of the submarginal cells, becoming still smaller farther inward, and yet they are distinct almost everywhere, and their sides often bulge strongly. They are thus distinctly bounded off from the thin places and differ in this respect from the trigones of the Alabama *N. crenulata*. The cuticle is striolate-verruculose and thus offers no points of distinction.

In a specimen collected by Macoun at Hastings, British Columbia (*No. 1245*) the measurements of the marginal and submarginal cells are about the same as in the Washington specimen, but the thickenings of the wall are less pronounced. Even here, however, the trigones are distinct and sometimes show convex sides. In Underwood's specimens from California (Hep. Amer. *200*) another type of variation is to be observed. Both the marginal and submarginal cells are a little larger, averaging respectively 30 and 27μ, while the median cells measure about 32×24μ. In some of the leaves the trigones are just as distinct as in the Washington specimen, but in many of the older leaves they have become obscured by the deposition of additional layers of thickening. This condition is by no means confined to Californian specimens. It occurs also in a plant collected by Macoun at Ucluelet, British Columbia (*No. 72*), where it seems to be associated with a pigmentation of the wall.

It will be seen from this account that the leaves of the more robust and typical forms of *N. rubra* are distinguished by very slightly enlarged marginal cells and by distinct trigones usually with bulging sides. In the typical form of *N. crenulata*, on the other hand, the leaves are distinguished by greatly enlarged marginal cells and by minute and often poorly defined trigones, usually with concave sides. If these distinct features are regarded as culminating conditions, they may well serve as the basis for a specific separation, even if poorly developed forms sometimes approach each other closely.

Aside from the differences in the leaf-cells there are certain differences in habit and in the disposition of the leaves on the stem, which deserve a few words of comment. In *N. crenulata* the stems usually cling very closely to the substratum, and rhizoids are found close to the growing tips; in *N. rubra* the older parts of the stem often cling closely, but the younger parts tend to be ascending or suberect, so that no rhizoids are to be found in the vicinity of the tips. Sometimes, especially in the case of slender branches with distant leaves, this condition is intensified and the axis will be free from rhizoids as far back as the sixth pair of leaves or even farther. As Howe has pointed out, "the leaves are sometimes slightly more decurrent" in *N. rubra* than in European forms of *N. crenulata.* This appearance of greater decurrence is due in part to the fact that the lines of leaf-attachment are often less oblique in *N. rubra* and might even be described as subtransverse in certain cases (as in FIG. 4), if the decurrent portions were left out of account. From these lines of attachment the leaves usually spread widely, but owing to their strong concavity they often present the appearance of clasping the stem (see FIGS. 1–3). In *N. crenulata* these conditions are scarcely apparent. The leaves are not only more obliquely attached but they are less concave and spread less widely, so that the whole shoot often appears laterally compressed. In the male bracts of *N. rubra,* as would be expected, the appearance of clasping is especially pronounced (FIGS. 5 and 6), but the bracts still spread distinctly from the axis. In *N. crenulata,* as shown clearly by Müller, the degree of spreading is less and the appearance of lateral compression, already noted in the vegetative shoots, is still to be found. The bracts of *N. crenulata* are further distinguished by their revolute margins, a condition not found in *N. rubra.* Müller notes the fact that the male plants of *N. crenulata* appear more delicate than the female. In *N. rubra* the male plants are often fully as robust as the female, but exceedingly slender individuals sometimes occur, one of which is shown in FIG. 6. Aside from the small size of the leaves and bracts these slender plants show few distinctive features.

In both *N. crenulata* and *N. rubra* very shallow perigynia are developed and the perianths are essentially alike. The latter organs (FIGS. 1–4) are narrowly to broadly ovate or obovate in outline and are sometimes laterally compressed. In the upper part four distinct folds are commonly present. At the contracted mouth a short beak may or may not be developed. The cells of the perianth are elongated in the region of the mouth, those bounding the opening projecting as crenulations or very short cilia. On the inner surface some of the cells often project slightly in the same way.

The sporophytes apparently yield no differential characters. According to Douin[1] the structure of the stalk is very uniform in *N. crenulata,* showing (in cross section) three concentric rows of cells, the outermost composed of sixteen, the second of eight, and the innermost of four. Müller gives sixteen to eighteen cells for the outermost row and eight to twelve for the second, so that the numbers are evidently more variable than Douin implies. In a section cut from a stalk of *N. rubra* (Cathlamet, Washington, *Foster 512*), the outermost row showed nineteen cells, the second nine, and the innermost six, numbers which indicate a similar variability. The cells of the capsule valves have been measured in both species and are essentially alike, those of the outer layer averaging about

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[1] Bull. Soc. Bot. France **50**: 369. *pl. 6, f. 8.* 1908.

27×21μ, while those of the inner layer measure 30–60μ in length and 9–13μ in width. The spores and elaters are likewise very similar in the two species.

8. **Nardia subelliptica** Lindb. Meddel. Soc. F. et Fl. Fenn. **9**: 182. 1883; Kaalaas, Nyt Mag. f. Naturv. **33**: 386. 1893. *Eucalyx subellipticus* Breidler, Mitt. Naturw. Ver. Steiermark **30**: 291 1893. [Text figs. 8–15.]

Collected in the summer of 1915 at the following two stations on Cape Breton Island, Nova Scotia, by G. E. Nichols: valley of the Barrasois (*Nos. 1269 & 1478*); mountains west of Ingonish (*No. 1725*). These specimens have already been reported by their collector under the name *N. obovata.*[1] The present species was based on material collected by its author at Blesebäck near Kongsvold, Dovre, Norway. Breidler extended its known range by recording it from several localities in Styria, and it is now known in addition from Germany (Harz Mountains and Bavaria), the Voralberg, Switzerland, Tirol, Lower Austria, France, Italy, Scotland, the Faroe Islands and Iceland. It grows on damp or wet rocks and prefers relatively high altitudes, except in the northern part of its range.

When Lindberg first proposed *N. subelliptica* he compared it with slender forms of *Jungermannia pumila* With., but pronounced it a true *Nardia,* most closely allied to *N. obovata.* Its relationship to *N. obovata* is indeed so close that certain European writers refuse to recognize its validity altogether, while others regard it as a "small" species. The latter view is held by Müller, according to whom it is distinguished from *N. obovata* by its small size and yellowish green color and also by differences in the shape of the leaves and in the cuticle of the cells. He describes the leaves of *N. subelliptica* as elliptical from an almost transverse base and the cuticle as smooth or minutely verruculose ("punktförmig papillös"), while he states that the leaves of *N. obovata* are broadly ovate to circular and that the cuticle is covered with distinct linear warts. One reason which he gives for recognizing the species is that *N. subelliptica* and *N. obovata* seem never to occur in the same locality. This mutual exclusion was first noted by Schiffner[2] but is not absolutely constant; both species are known to occur, fairly close together, in France, in the Faroe Islands and also in Nova Scotia.

In both *N. obovata* and *N. subelliptica* the following characters are present: a cespitose habit; intercalary branches, some of them differentiated as stolons; numerous rhizoids, usually more or less pigmented with purple; entire leaves, rounded at the apex; leaf cells of about the same size with distinct trigones and a more or less striolate-verruculose cuticle; a paroicous inflorescence; a well-developed perigynium; and a short plicate perianth, contracted but not rostrate at the mouth.

Although *N. subelliptica* seems to be invariably small, the difference in size which Müller emphasizes is not always present, since forms of *N. obovata* sometimes occur as small as *N. subelliptica.* The differences in color are likewise to be used with caution. Although *N. subelliptica* is usually yellowish green, a purplish pigmentation is sometimes present in the stems and leaves and may be fairly extensive. The differences in the cuticle are of even less importance. The differences in the form and disposition of the leaves, however, are

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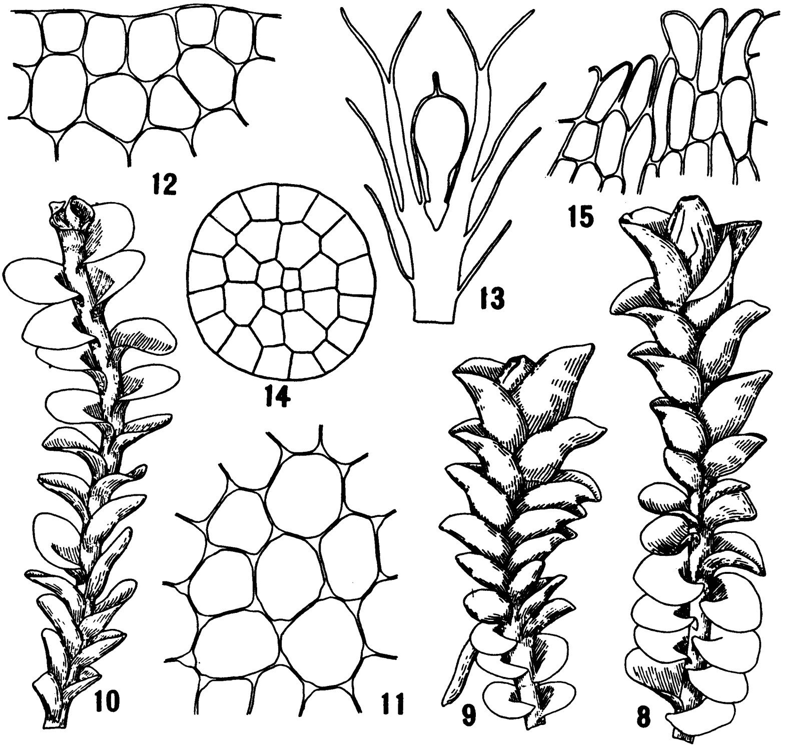
[1] Bryologist **19**: 41. 1916.

[2] Oesterr. Bot. Zeitschr. **58**: 4. 1908.



NARDIA SUBELLIPTICA Lindb.

FIGS. 8, 9. Plants with perianths and perigonial bracts, dorsal view, FIG. 9 showing also a stolon, ×15.

FIG. 10. Sterile plant, dorsal view, ×15.

FIG. 11. Cells from the middle of a leaf, ×265.

FIG. 12. Marginal cells of the same leaf, ×265.

FIG. 13. Longitudinal section of a young sporophyte and surrounding parts, ×25.

FIG. 14. Transverse section of the stalk of a young sporophyte, ×200.

FIG. 15. Cells from the mouth of a perianth, ×200.

The figures were all drawn from specimens collected in the mountains west of Ingonish, Cape Breton, Nova Scotia, by G. E. Nichols, No. 1725. The rhizoids and the verruculae of the leaf cells are not represented.

often very striking. In *N. subelliptica* the leaves are especially characteristic on sterile stems, like the one shown in FIG. 10. It will be noted that the lines of attachment, as Müller states, are almost transverse, that the basal parts of the leaves are strongly concave and spread obliquely, and that the apical parts tend to spread more widely. This lends the shoot a distinctly squarrose appearance.

In spite of the fact that *N. subelliptica* is normally paroicous, Schiffner noted the occasional presence of purely male branches in specimens which he collected near Hall in Tirol and distributed in his exsiccatae (Hep. Europ. Exsic. *376*), and similar branches occur in some of the Cape Breton material (*No. 1478*). In normal cases three or four pairs of perigonial bracts are usually developed, followed by one or two pairs of perichaetial bracts. In *N. obovata* the number of perigonial bracts is usually reduced to two or three pairs. The bracts of *N. subelliptica* are at first imbricated (FIG. 9) but tend to become separated later (FIG. 8). They are saccate at the base, and the keel is strongly arched in the lower part. The dorsal inflexed portion is usually nearly or quite as large as the rest of the leaf, so that the bracts present the appearance of being subequally complicate-bilobed. In the upper half the bracts often spread widely. The perichaetial bracts clasp the perianth (or perigynium) closely. They resemble the perigonial bracts in most respects but are less saccate at the base. Usually the innermost bracts are suberect, and this will often serve to distinguish them from the widely spreading bracts of *N. obovata;* but sometimes, unfortunately, the innermost bracts (as in the Tyrolese specimens distributed by Schiffner under No. 377) are just as squarrose as in *N. obovata*, so that this distinction is not always available.

Subfloral innovations have been observed with considerable frequency, not only in European material but also in the Nova Scotian. They are usually sterile for a while but sometimes give rise to inflorescences while still very short. It has already been noted (under *N. fossombronioides*) that subfloral innovations are either very rare in *N. obovata* or absent altogether. The perigynium in *N. subelliptica* is unusually deep and often exceeds the perianth in length (FIG. 13). The latter organ, which projects slightly beyond the bracts, is delicate and composed throughout of elongated cells. It is plicate in the upper part, and the cells bounding the opening project as crenulations or short cilia (FIG. 15). Sometimes small groups of marginal cells project as vague and irregular teeth, but this appearance is much less marked than in *N. obovata.*

According to Müller the stalk of the capsule shows three concentric rows of cells in cross-section, the outermost composed of sixteen cells, the second of eight, and the innermost of four. This statement is confirmed by a section cut from Nova Scotia material (FIG. 14), but more sections would be necessary to prove that these numbers are constant. The cells of the capsule-wall are essentially like those of *N. obovata.*

Another species which should be compared with *N. subelliptica* is the recently described *N. obscura* Evans, known at present only from New England and New York. This species is somewhat more robust and usually much more deeply pigmented than *N. subelliptica* and is distinguished at once by its dioicous inflorescence. The leaves, moreover, are relatively broader and the perianth is distinctly shorter than the bracts. In other respects the species are much alike.

9. **Porella Cordaeana** (Hüben.) comb. nov. *Jungermannia Cordaeana* Hüben. Hepat. Germ. 291. 1834. *Madotheca Cordaeana* Dumort, Recueil d' Obs. sur les Jung. 11. 1835. *M. rivularis* Nees, Naturg. Europ. Leberm. **3**: 196. 1838. *Porella dentata* Lindb. Acta Soc. Sci. Fenn. **9**: 342. 1869. *P. rivularis* Trevis. Mem. Ist. Lombardo III. **4**: 407. 1877. *Madotheca dentata* Massal. Bull. Soc. Bot. Ital. 1904: 38. *M. lamelliflora* Steph. Sp. Hepat. **4**: 250. 1910.

A few years ago Müller[1] demonstrated the fact that *Jungermannia Cordaeana* Hüben. was the oldest valid name for the present species. He consequently revived for it the name *Madotheca Cordaeana* (Hüben.) Dumort. For those who maintain the Linnaean genus *Porella*, in place of the much later *Madotheca*, the above new combination becomes necessary. The writer[2] has pointed out the distinctive features of *P. Cordaeana*, in connection with a discussion of *P. platyphylla* (L.) Lindb., and has shown that it is confined, in North America, to the western part of the continent. Specimens have been examined from Alaska, British Columbia, Washington, California, Idaho and Montana.

10. LEPTOCOLEA CARDIOCARPA (Mont.) Evans, Bull. Torrey Club **38**: 268. *pl. 12, f. 1–3.* 1911. *Lejeunea cardiocarpa* Mont.; Ramon de la Sagra, Hist. Cuba **9**: 476. *pl. 18, f. 4.* 1845.

Collected in 1918, in the vicinity of Sanford, Florida, by S. Rapp (*Nos. 92 & 93*). New to the United States but widely distributed in the American tropics. In the last paper of this series the number of Lejeuneae definitely known from Florida was estimated as thirty-eight. Last year the writer[3] was able to report the six following species, all collected by Rapp in the vicinity of Sanford: *Cololejeunea contractiloba*, *Lejeunea cladogyna*, *L. longifissa*, *Rectolejeunea Maxonii*, *Euosmolejeunea parvula*, and *Ptychocoleus heterophyllus*. These, together with the *Leptocolea* just reported, increase the total number of Florida Lejeuneae to forty-five.

The most important distinctions between *Leptocolea cardiocarpa* and the closely related *L. Jooriana* (Aust.) Evans are found in the male inflorescence. *L. cardiocarpa* is an autoicous species and the male bracts occupy a more or less elongated branch, each bract bearing as a rule two antheridia. *L. Jooriana*, on the other hand, is paroicous and the male bracts, which are usually monandrous, are situated close to the perianth. In other respects the species agree closely.

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## EXPLANATION OF PLATE II

NARDIA RUBRA (Gottsche) Evans

FIGS. 1–3. Plants with perianths, dorsal view, 15.
FIG. 4. Plant with perianth, lateral view, ×15.

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[1] Rabenhorst's Kryptogamen-Flora **62**: 585. 1915.
[2] Rhodora **18**: 106–109. 1916.
[3] Am. Jour. Bot. **5**: 131–150. 1918.

FIGS. 5, 6. Male plants, mostly in dorsal view, X15.

FIG. 7. Cells from the apex of a stem-leaf, X265.

FIG. 1 was drawn from a specimen collected above Hoquiam, Washington, by A. S. Foster, No. 759; FIG. 2 from a specimen collected at Pacific Beach, Washington, by the same collector; and the remaining figures from specimens collected at Renton, Washington, by T. C. Frye, No. 22. The rhizoids are not represented.

NARDIA CRENULATA (Sm.) Lindb.

FIG. 8. Cells from the apex of a stem-leaf, X265.

Drawn from a specimen collected in the valley of the Barrasois, Cape Breton, Nova Scotia, by G. E. Nichols, No. 1376.

NARDIA CRENULATA GRACILLIMA (Sm.) Lindb.

FIG. 9. Cells from the apex of a stem-leaf, X265.

Drawn from a specimen collected near Herlisheim in the Vosges Mountains, by C. Müller, and distributed in Schiffner's Hep. Eur. Exsic. *361*.

## MISCELLANEOUS NOTES

**Eocronartium muscicola, a fungus parasitic on moss.**—FITZPATRICK[1] has recently published a detailed account of the life history and parasitism of this fungus, giving also some natural sized photographs of *Climacium americanum* bearing the mature fungus. Probably some of our readers have noticed this fungus as it occurs on a considerable number of species of mosses: the author obtained most of his material from *Climacium americanum*, but he finds that it has been collected also on *Anomodon rostratus*, *Leskea obscura*, *L. polyantha*, *Thuidium delicatulum*, *T. minutulum*, *Amblystegium serpens*, *A. varium*, *A. riparium*, *Brachythecium oxycladon*, *Climacium dendroides*, *C. Kindbergii*, *Entodon seductrix*, *Hypnum chrysophyllum*, *Plagiothecium Muellerianum*, and *Pylaisia intricata*. It is interesting to note that the hosts, thus far reported, are all members of the two closely related families *Leskeaceae* and *Hypnaceae*.

The mycelium of the fungus persists perennially in the moss, growing up through the stems and leaves as the new shoots develop, matting together the leaves and enveloping the growing point, and eventually forming a slender club-shaped or cylindrical, usually unbranched structure often with a somewhat enlarged base, and in larger mosses, like *Climacium*, sometimes reaching a length of 6 cm., commonly about 2 cm. The author publishes the name *Eocronartium muscicola* (Fries) Fitzpatrick, synonyms being *E. typhuloides* and *E. muscigena;* the name *muscicola* having also been placed under the genera *Clavaria*, *Pistillaria*, and *Typhula* by various authors.

As to the origin of the rust fungi the suggestion is made by the author:

"Admitting that the rust fungi on ferns constitute a primitive type, it is carrying the argument only one step farther to suggest that the ancestors of these forms occurred on mosses. The Uredinales probably arose from forms similar to those now embraced in the *Auriculariaceae*, their high degree of speciali-

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[1] Fitzpatrick, Harry N. The Life History and Parasitism of Eocronartium muscicola. Phytopathology 8: 197–218. May, 1918.